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Geography, environment and flora of Mt Mulanje, Central Africa

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Abstract

Mt Mulanje in Malawi is the highest mountain in Central Africa, rising to 3002 m, and is one of the world's largest granite inselbergs. The mountain is formed of a series of coalescing domes of syenite, rising 2000 m above the surrounding plain. It is completely isolated and measures over 20 km at the base along each of its four sides. Almost bare slabs of rock sweep up from the base, covered with little but lichens and scattered *Xerophyta* plants. At about 1800 m, summits of some of the granite domes begin to provide plateau surfaces covered where the soil is deepest by the famous forests of Mulanje cedar *Widdringtonia nodiflora*, and where it is shallow and rocky by scrub. The latter community contains scattered individuals of a dwarf form of *Widdringtonia* with *Philippia benguelensis* and other species including *Protea nyasae* and *P. welwitschii*. Towards the mountain summits the composition of the scrub changes to dominance by *Erica whyteana* and *E. johnstoniana* with *Blaeria kiwuensis*. Lichens are dominant on exposed summits. The rainfall on Mulanje is said to be very high, between 2000 and 3000 mm annually, with a high incidence of cloud. The mountain is one of the most important surviving habitats for Afro-montane forest and fynbos scrub.

Introduction

Mt Mulanje is one of the world's most impressive granite inselbergs, a huge isolated mass of rock rising to 3002 m, which makes it the highest mountain in Central Africa. It is formed of a series of coalescing domes of syenite which stand up at least 2000 m above the surrounding plain. The mountain is completely isolated and covers an area of 640 km^2 (Eastwood 1988). When one visits Ayers Rock one is told that it is the "world's largest monolith", whatever that is supposed to mean, presumably an outcrop free from stratification, joints or fissures. Mulanje also fits that description and is many times larger than Ayers Rock in length, breadth and volume.

Geography and Geology

The mountain is situated at 16 ° S 36 ° E, well within the tropics. It owes its existence to the tectonic movements along the great African Rift Valley, in which it is situated some 200 km south of Lake Malawi (formerly Lake Nyassa) which lies in a particularly deep and well-marked section of the Rift. The lake, 600 km long, stands at 474 m above sea level and is 695 m deep at its deepest point. The lake is drained southward by the Shire River which flows to the Zambezi. The Rift Valley south of Lake Malawi contains a few smaller lakes, *e.g.* Lake Malombe and Lake Chilwa, but gradually ceases to have surface expression. The horst forming Mt Mulanje has been upthrust at the southern end of the Rift. Like the famous Mt Kinabalu (4100 m) in north Borneo, it is a mass of granite thrust upward by underground pressures and probably of no very great geological age.

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Vegetation

Owing to its topographic elevation the mountain attracts a very high rainfall of between 2000 mm and 3000 mm annually, and is frequently covered by cloud. On the other hand, soils are generally shallow and patchy with much bare rock exposed and it is this factor, together with the fires that regularly sweep the mountain in the dry season, which principally determines the nature of the vegetation. Rock surfaces are never absolutely bare but are covered with lichens (*Peltula* and *Usnea* spp) and a sedge (*Coleochloa setifera*), forming grass-like tufts. Larger, woody plants grow in crevices. Where more soil is available these grow taller and more widespread, and eventually one particular shrub *Widdringtonia nodiflora* may assume tree stature and form extensive forests.

The botany of Mulanje was explored by Alexander Whyte in 1891, leading to the description of a number of new and endemic species. More detail is obtainable from the recent work of Chapman (1962), Chapman & White (1970) and Porembski (1996). When I visited the mountain some years ago, an expedition was kindly laid on for me by the Forests Department of Nyasaland, who provided four Africans as guides and carriers. The inaccessibility of Mulanje is such that it is one of the few parts of the world that have not been conquered, even now, by the 4WD vehicle, and we had to make the ascent on foot. The prospect at first was daunting. From gentle lower forested slopes the mountain suddenly sweeps up in towering slabs of bare rock covered only with lichens, *Coleochloa* and a few woody plants mainly *Xerophyta splendens* (Velloziaceae) growing in crevices. The *Xerophyta* community has many unusual features which have been described by Porembski (1996). Fortunately a path for the ascent was available, through less abrupt, bush-covered slopes. At about the 1800 m level we reached the top of the first ascent and gained an uneven plateau affording sweeping views of the clouds covering

the lower country around. From here too a view is available of the off-lying Chambe Peak of the main massif, embracing a plateau devoted to forestry where natural cedar forests are being worked and augmented by plantations. Timber is (or was at that time) extracted by aerial ropeway.

Eventually we reached the welcome shelter of the forest resthouse, Lichenya cottage, built entirely of local cedar timber with cedar shingles. The resthouse is surrounded by cedar forest formed by the cypress-like tree *Widdringtonia nodiflora* which is very similar to any Australian cypress pine (*Callitris*). Just as the latter usually represent a relict vegetation growing in fire-protected places, so *Widdringtonia* trees have evidently been more abundant in the past in more pluvial times. As with *Callitris, e.g. C.roei* in Western Australian kwongan, there has been a speciation into shrub-sized species which have become components of the South African fynbos. The trees on Mulanje are heavily lichened as a result of the damp cloudy atmosphere. None-the-less, fires may often occur in dry periods in spite of the high rainfall, and the forest can be seen to be very patchy.

The summit of the mountain was in plain view from the resthouse, but having taken most of the day to walk up there, enough was enough for the present; I spent the evening in front of a cheerful log fire of cedar wood. Next morning, unfortunately and to my consternation, the clouds were down and we could see nothing. It was useless to try to find one's way to the summit under these conditions, so my African attendants and I padded around in the fog and the drizzle doing a little botanising. The following day was still cloudy but much better, and so it was decided to strike for the summit.

Shallow rocky places above the forest are covered by a scrub similar to the fynbos of the Cape mountains containing a dwarf form of the *Widdringtonia* with *Philippia benguelensis* and other species of Ericaceae, and an endemic protea, *P. nyasae*, which I was particularly looking for at the time. Higher up the composition of the scrub changes to dominance by *Erica* spp, chiefly *E. whyteana* and *E. johnstoniana*, with *Blaeria kiwuensis*. These communities with local endemic species are typical of the so-called ericaceous zone of high East African mountains (Hedberg 1951). Some ericas are mat-forming species, while others are substantial shrubs.

Keeping the top of the mountain in sight, we luckily discovered a little track that had been beaconed, as I discovered later, by the Mountain Club of Nyasaland, and which led to the top. I was glad of this, as I was nervous that the clouds might come down again and make it difficult for us to find our way back. Luckily this did not happen, but one can understand that in a topography of granite domes to strike off straight down hill may lead one into a situation of even increasing steepness and can be dangerous. We returned safely and in clear weather. The summit has very little vegetation except lichens.

Biogeography

From the point of view of biogeography, the flora of East African mountains is interesting for its close relationship to that of the Cape mountains in South Africa which are well known to feature a shrubland formation known locally as fynbos (Cowling 1992) in which woody species belonging to the families Ericaceae, Fabaceae and Proteaceae are dominant, with many herbaceous perennials in the ground layer, especially Restionaceae. Fynbos is in many ways similar to the kwongan of south-western Australia (Pate & Beard 1984), the principal difference floristically being that Ericaceae are replaced by Myrtaceae in Australia. As with kwongan, fynbos typifies a particular phytogeographic region known at one time as the Cape Floral Kingdom, nowadays preferably as the Cape Floristic Region. Climatically this is subject to a winter rainfall maximum in the west, merging into a non-seasonal regime in the east. Beyond the eastern end of the Cape Floristic Region the rainfall pattern changes to summer maximum which encourages the growth of grass, so that annual fires become a feature of the environment and grasslands are predominant. Within the fynbos region where grasses are insignificant fires occur less frequently and the shrubland can regenerate free from grass competition. In the summer rainfall area we have evidence from relictual patches that fynbos is properly the climax vegetation in the mountains but has been largely eliminated by burning (Beard 1993). Such relics continue to occur all along the mountain chains and escarpments of eastern Africa at increasing altitude right up to the Equator and beyond into Ethiopia.

Another feature of this situation is that small scattered populations of *Widdringtonia* are also found, the best known being in the Cedarberg in the western Cape mountains. These follow the fynbos relics as far north as Mulanje, beyond which they are replaced by *Juniperus procera* as the ecological equivalent. The fossil pollen record shows widespread abundance of *Widdringtonia* in the past and it is reasonable to assume that it represents a prior climax vegetation which preceded fynbos on poor acid soils in these mountain situations. *Widdringtonia* is very sensitive to fire and it can only have been dominant when fynbos fires were less frequent and destructive, perhaps when rainfall generally was much higher, and also when humans – particularly cattle-keeping humans – were less numerous. A parallel situation exists in Western Australia where small relict populations of *Callitris* exist in fire-protected places – on coastal islands which were not reached by aborigines, or on cliffs and rocky places in the interior where there is insufficient grass to carry fire (Beard 1990). In this context Mt Mulanje is the most important refuge for the survival of *Widdringtonia* populations.

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